

energy being transferred, but cheerfully introduces this new idea of a peripatetic entropy.

The fact is, so soon as a man departs from the mathematical definition of a quantity like entropy, he is in danger of all sorts of inconsistency. Conduction of heat implies that temperature is *not* constant in the thinnest slice of a bar or portion of fluid, and we have no right to speak of the entropy of a portion of stuff or of its pressure or of its temperature unless it is in the same state throughout. It is obvious that underlying Mr. Swinburne's statements throughout this book it is not always the entropy of a quantity of stuff that he thinks of; it is often the entropy of a quantity of heat, just as if we said:—Heat H in the furnace at a high temperature θ_1 has entropy H/θ_1 ; in the water of the boiler θ_2 is the much lower temperature, and the entropy H/θ_2 is much greater than in the furnace, and so on. Wherever there is conduction or any kind of irreversible operation there is a growth of entropy. This sort of representation is familiar to all users of the $\theta\phi$ diagram, but they know how to put the matter quite clearly (see NATURE, April 30, 1903) without using terms in a wrong sense, without confusion of ideas, without condemning wholesale what other men have written, without contradicting the fundamental laws of thermodynamics.

This notice may seem to be unduly long; I may seem to waste valuable space in NATURE and give undue importance to an unscientific book. But unhappily it is necessary. Mr. Swinburne's vague denunciations of writers on thermodynamics in letters and articles to the engineering papers have done a great deal of harm to young engineers, and I am peculiarly bound to the very ungrateful task of pointing out his mistakes. A writer who proves that the earth is flat deserves no notice, for he can do no harm, but although Mr. Swinburne's heresies are just as unscientific, just as absurd, they must be noticed and condemned. He uses a jargon which sounds quite scientific to a young engineer; he involves a reader in his mistakes so persuasively that if this reader is an earnest young engineer I feel sure that he must get utterly discouraged with the idea that the study of thermodynamics can be of any use to him. Probably the best of antidotes to this poison are the two articles in NATURE referred to at the beginning of this notice.

JOHN PERRY.

AGRICULTURAL EDUCATION AND RESEARCH IN INDIA.

THE last mail brings an issue of the Allahabad Pioneer, containing the resolution of the Government of India regarding the establishment of an agricultural college and research station at Pusa, in Bengal. It will be remembered that Mr. Henry Phipps gave a sum of 20,000*l.* to be devoted to whatever object of public utility (if possible in the direction of scientific research) the Viceroy might prefer, and on the decision to create with this sum an imperial centre for agricultural investigation Mr. Phipps increased his donation by another 10,000*l.* It was at first proposed to make the existing laboratory at Dehra Dun the nucleus of the new work, but the superior advantages offered by the estate at Pusa have resulted in the decision "to make Pusa the headquarters of the Imperial Agricultural Department, and to establish there the laboratories required by the experts, combining with them farms which will offer every convenience for practical work, and an agricultural college." For this purpose the estate has been transferred from the Government of Bengal to the Govern-

ment of India, and the existing staff at Dehra Dun will move to Pusa when the laboratories are ready, which is expected to be in September, 1905.

The agricultural college is intended to serve not only Bengal, but the whole of India, and to provide a supply of trained men, who "will be required to fill posts in the Department of Agriculture itself, such as those of assistant directors, research experts, superintendents of farms, professors, teachers, and managers of court of wards and encumbered estates."

At the research institute it appears that the staff is to consist of two chemists, one being specially concerned with bacteriology, two botanists, one cryptogamic, the other "biological," and an entomologist.

This scheme ought to grow into an institution of the utmost value to India, a country which is full of agricultural industries, involving great interests, yet proceeding wholly by rule of thumb tempered by occasional analyses performed in London. Systematic investigations of the conditions of the industry on the spot have been wanting except latterly among the tea-planters of Ceylon and Assam. Indigo growing affords a case in point; for years it was obvious that the natural product was going to meet with severe if not ruinous competition, yet nothing was done until the artificial indigo had reached the position of being able to undersell the Indian article, then at last a chemist and a bacteriologist were hurried out to try to save the failing industry. But how can the most eminent scientific man be expected to descend from Europe like the god from the car and revolutionise an old and complicated business at sight?

The new institute at Pusa will be well situated among some of the best agricultural developments in India, so that the scientific staff will have an opportunity of learning where their skill can be of service to the cultivator, and of trying to keep this or that industry in a healthy condition instead of being called upon to resuscitate it when *in extremis*. There may be even now a chance for the grower of indigo if only he is given some of the systematic scientific effort which has hitherto been the monopoly of his competitor.

NOTES.

PRESS messages from New York contain an account of the discovery, by Prof. Baskerville, of the University of North Carolina, of two new elements possessing somewhat remarkable properties. By distilling thorium oxide in a quartz tube with carbon and chlorine there are produced a greenish condensable vapour to which the name berzilium is given, and a crystalline, pinkish substance which adheres to the quartz tube and is named carolinium, whilst a certain quantity of thoria remains unchanged in the tube. Prof. Baskerville has at his disposal 5 grams of carolinium and 2.5 grams of berzilium, presumably in the form of volatile chlorides. In a lecture before the Chemists' Club Prof. Baskerville exhibited the two elements in a darkened room, and showed that each of them is capable of shedding an illumination through tubes of copper, brass, iron and glass, all covered with cloth. Further investigations are in progress, in which Prof. Zerban, of Berlin, will cooperate.

PROF. R. W. BOYCE, F.R.S., has been appointed a special advisory member of the committee of the African trade section of the Liverpool Chamber of Commerce on matters relating to health and sanitation.

REUTER'S Agency is informed that the British Antarctic vessel *Discovery*, with Captain Scott and his staff, is not

likely to return to England before the autumn. It is expected that the relief ships *Morning* and *Terra Nova* will sail direct for home.

A REUTER message from Montreal, dated April 7, states that "The Board of Trade has decided to take steps to second the proposal of the London Chamber of Commerce to organise tours throughout Canada for English university graduates, as moved at the Congress of Chambers of Commerce held last summer."

THE opening meeting of the Sociological Society will be held at the School of Economics and Political Science, Clare Market, W.C., on Monday next, April 18, when Dr. E. Westermarck will read a paper on woman in early civilisation. The following papers have also been arranged:—May 16, Mr. Francis Galton, F.R.S., on eugenics: its definition, scope and aims; June 20, Prof. E. Durkheim and Mr. V. Branford, on sociology and the social sciences; July 18, Mr. Patrick Geddes, on civics as applied sociology.

M. DE FONVIELLE writes that at a recent meeting of French meteorologists in Paris M. Bouquet de la Grye delivered an address in which he referred to the extent of the work of the French meteorological service. The number of stations in connection with the service sending observations twice daily to Paris is 126, of which 72 are in foreign parts and 7 are mountain observatories. During 1903 it appears that sixty storms visited the coasts of France, of which fifty were announced by telegrams. Ninety per cent. of the storm warnings published in the Press were verified. During the same year the meteorological kites reached the great height of 5960 metres. The conclusion of the speech of M. Bouquet de la Grye was devoted to the work of Sir Norman Lockyer on the connection between solar and terrestrial phenomena.

SOME of the effects produced by the high altitudes traversed by the Tibet expedition were referred to last week (p. 540). Imperfectly cooked food caused indigestion among the troops, and congealed oil led to difficulties with the magazines of the rifles. Commenting upon these points a correspondent of the *Times* remarks:—"Any tiro in physical science could have told the military authorities that at 15,000 feet above the sea oil ceases to be a lubricant and becomes a clog. Also that the temperature of water boiling in an open vessel falls roughly two degrees Fahrenheit for every 1000 feet you ascend. He could also have given the remedy in both cases. Our men ought to have had pure glycerine to lubricate the locks of their rifles and Maxims. They ought to have had cooking-pots with airtight lids furnished with simple safety valves blowing off at a pressure of 15 lb. on the square inch. Then they would have had no trouble either with rifles or cooking. The tiro could also have pointed out that the elasticity of springs, and especially of certain kinds of spring, is greatly affected by temperature, and that it would have been well to test the Maxims at such temperatures as they would certainly have to encounter."

THE Deutsche Seewarte has made a very useful addition to its international ten-day weather report by the issue of charts showing, for 8h. a.m. each day, the distribution of atmospheric pressure over the North Atlantic between the continents of North America and Europe by means of isobaric lines, with arrows denoting wind direction and force. The positions of the areas of high and low barometric pressure are plainly shown, and are the more interesting and valuable from the fact of the publication of the charts so soon after date. The supplement to the

weather report of April 1 last, for instance, contains the daily isobaric charts for March 1-10, together with tabular statements as hitherto of the ten-day results of pressure, temperature, and rainfall at stations in North America, Europe, and intermediate islands.

IN several papers descriptions have recently appeared of a "novel method of electric traction," in which the current is employed to generate steam in an ordinary locomotive boiler by means of an electric furnace. The system is obviously very wasteful of power from a thermodynamic point of view, and those who wish to learn what the waste would amount to under actual conditions will find a letter on the subject, by Mr. Arnold G. Hansard, in *Knowledge and Scientific News* for April.

AN interesting account of the Imperial University of Tokyo is contributed to a recent number of the *Popular Science Monthly* by Mr. Naohidé Yatsu. It will probably interest European readers to learn that "in so remote a time as the eighth century a university had already been established in Japan that included such modern divisions as schools of medicine, ethics, mathematics, history, and that some of the text-books employed at that remote period dealt with such subjects as the diseases of women, *materia medica* and veterinary surgery, types of text-books which appear to have been unknown in European countries until about 1000 years later."

A RECENT number of the *Revue générale des Sciences* contains a short note on the Arnold electropneumatic system of traction, the object of which is to overcome the difficulties connected with electric traction by alternating currents consequent on the variable velocity of the train. The motor in this case consists of a stator and a rotor, of which the latter is directly fixed to the axle of the wheel. The stator is, however, free to rotate, but by doing so it operates on a condensing pump connected with an air engine, which in its turn works on the wheels. When the train is running at a speed corresponding to synchronism, the stator remains at rest, and the apparatus then works like an ordinary alternate current motor. In starting the train, on the other hand, the pneumatic action is brought into play, the necessary synchronism being maintained by the rotation of the stator.

A PAPER has been communicated to the Vienna Academy by Dr. N. Herz on a generalisation of the so-called "problem of eight points." The problem may be stated as follows:—If from any four points the twelve angles subtended by four objects are measured, or if from any three points the twelve angles subtended by five points are measured, then the relative positions of the eight points are completely determined. The importance of the problem is obvious in connection with the photographic survey of unexplored districts, as by comparing the relative positions of the same five objects on three different plates, a plan of the region can be constructed with greater precision than is possible with sketches.

THE catalogue of additions to the library of the Botanic Gardens, Kew, received during 1903, forms appendix ii. to the *Bulletin* and is printed as usual on one side of the paper only, so that the titles may be cut out if desired.

A PAMPHLET dealing with diseases of the sugar cane has been received from the Imperial Department of Agriculture for the West Indies. This contains the substance of three lectures delivered by Mr. Lewton-Brain, the official mycologist in Barbados, in which special consideration was given to the rind and root diseases. As Sir Daniel Morris

mentions in the preface, the rind fungus caused the damage to the canes in 1895, but this was overcome by the introduction of a resistant variety. The root disease caused even greater disaster last year, and as so far no variety has been obtained which is resistant to its attack, the planter has to adopt more laborious and continuous measures of dealing with it.

JUDGING from the fact of its having reached a third edition, Dr. Hoyle's "Handy Guide" to the Manchester Museum appears to be highly appreciated by the class of visitors for which it is intended.

DR. R. W. SHUFELDT, in the January number of the *American Naturalist*, discusses the osteology and systematic position of the grebes and divers (Pygopodes). The author maintains his former opinion as to the probability of these birds being the descendants of toothed divers more or less closely allied to the American Cretaceous *Hesperornis*, the grebes exhibiting the most marked traces of this relationship. As the flightless *Hesperornithidae* themselves are doubtless the descendants of flying types, so, in the author's opinion, our modern grebes and loons may, if they survive long enough, become in the course of ages modified into forms incapable of flight.

THE biological articles in the January number of the *Journal* of the Straits Branch of the Royal Asiatic Society include an account of new Malayan plants by Mr. H. N. Ridley, a list of Bornean butterflies by Mr. R. Shelford, the description of certain Hymenoptera in the Raffles Museum at Singapore by Mr. P. Cameron, and notes by Mr. G. B. Cerruti on the Sakais of Batang Padang, Perak. Although it may be doubtful whether the forest aborigines whom the Malays designate Sakai are really true Negritos, Mr. Cerruti's essay demonstrates that they are certainly of a very low grade, being destitute of either written records or of signs to represent language.

In the *American Naturalist* Mr. R. S. Lull continues the "symposium" on the adaptive modifications of mammals, taking for his text those induced by the exigencies of a cursorial mode of existence. Naturally the greatest modifications occur in the limbs, but correlated with this is also an elongation of the head and neck in long-legged types. Adaptation for speed is further exhibited in the moulding of the shape of the body so as to present the minimum amount of resistance to the air, as well as in increase in heart and lung capacity to meet the extra expenditure of energy. Finally, in the jumping forms we meet with an increase in the length and weight of the tail, which has to act as a counterpoise. As regards the feet, a reduction in the number of digits is a frequent feature, more especially among the hoofed forms, where the culmination in this respect is attained by the existing members of the horse tribe and certain representatives of the extinct South American *Protheriidae*, both of which are monodactyle.

ACCORDING to the report of the Marine Biological Association of the West of Scotland for the past year, which is illustrated with a portrait of Sir John Murray, the station at Milford has undergone considerable enlargement and extension through the liberality of Mr. J. Coats, jun. Notwithstanding the building operations, which commenced in May last, the work of nearly all the departments shows an excellent record for the year. It is satisfactory to learn that Sir John Murray, who has filled the office of president for the last three years, has offered three prizes of 50*l.* each for papers on that number of subjects connected with the work of the association. The prizes are given in memory

of the late Mr. F. P. Pullar, who was long associated with Sir John in the bathymetrical survey of the Scottish lochs, and who lost his life in an ice accident in February, 1901. "These prizes are open for competition to investigators from any part of the world who conduct observations in the several subjects at the Millport Marine Station, and who produce at any time before January 1, 1905, papers which, in the opinion of a committee of three scientific men, to be nominated by the Association and by Sir John Murray, shall be deemed to be of sufficient value to merit publication."

PROF. LOEB, whose work on artificial parthenogenesis is well known, has recently succeeded in causing the fertilisation of the egg of the sea-urchin by the sperm of the starfish. This interesting result has been brought about by altering the constitution of the sea-water, preparing an artificial sea-water (NaCl 100, KCl 2.2, MgCl₂ 7.8, MgSO₄ 3.8, CaCl₂ 2 in half gram-molecular solution), and rendering it slightly alkaline with caustic soda (0.3-0.4 c.c. of deci-normal NaOH per 100 c.c. of the solution). In this some 50-80 per cent. of the sea-urchin (*S. purpuratus* and *S. franciscanus*) eggs may be fertilised in a short time by the addition of living sperm of a starfish (*A. ochracea*). The eggs form a membrane of fertilisation, and at the proper time segment and develop into swimming larvæ. The ultimate development of these hybrid larvæ has yet to be observed (*University of California Publications, Physiology*, vol. i., No. 6, 1903).

THE problem of the further development of *Halteridium*, a blood parasite of birds, and its definitive host has until now remained unsolved. Schaudinn has recently published an exhaustive paper on the cycle of development of a *Halteridium* of the little owl (*Athene noctua*). He traces the further development of the parasite in the middle intestine of the common gnat, *Culex pipiens*, and finds that in this insect it becomes a well defined flagellated organism or trypanosoma. The male and female gametes conjugate in the mosquito, and certain of these cells develop into asexual trypanosomes, others into thick trypanosomes having female characters, and others into small slender trypanosomes having male characters. The parasites congregate in the poison-gland of the insect, whence they are injected into a fresh host when it bites. The trypanosome forms then attack the red blood cells, enter these, and lose their flagella, becoming the intra-corpuseular *Halteridium* forms once more. Schaudinn re-names the parasite *Trypanosoma noctuae* (*Arbeit. aus d. kaiserl. Gesundheitsamte*, xx., Heft 3).

It is quite clear from the report of the council and proceedings of the Hampstead Scientific Society for the year 1903—a copy of which has been received—that the association is doing good and useful work, particularly at meetings of sections, of which there are three—astronomical, natural history, and photographic. The number of members now stands at 315, a total increase of 29 members since the last report.

THE first part of "A Technological and Scientific Dictionary," edited by Messrs. G. F. Goodchild and C. F. Tweney, and published by Messrs. George Newnes, Ltd., has been received. It consists of 64 pages, and contains articles, definitions, and terms of science and technology in subjects the names of which begin with letters from A-B(ow). The dictionary is to be completed in fifteen parts, and each part costs a shilling net.

MESSRS. HARRY W. COX, LTD., have sent us a copy of a new illustrated catalogue of their induction coils, inter-

rupters, X-ray tubes, apparatus for fluoroscopy and radiography, primary and secondary batteries, high frequency apparatus, dynamos, and other instruments. Many useful details as to the various instruments are described; and the catalogue also contains about thirty pages of practical hints to beginners, which will prove of assistance to those who propose to work with Röntgen ray, high frequency and electromedical apparatus.

A SECOND edition of Prof. Stanislas Meunier's volume on "La Géologie expérimentale" has been published by M. Félix Alcan, Paris. The work contains many ingenious and instructive experiments illustrating the phenomena of geology and physical geography, and most of them can be performed successfully with very simple appliances. The original edition was reviewed in NATURE in August, 1899 (vol. ix. p. 388), and the new volume, though dealing essentially with the same subjects, is differently arranged, and includes much new matter.

PROF. W. OSTWALD'S "Grundlinien der anorganischen Chemie" (Leipzig: Engelmann; London: Williams and Norgate), which originally appeared in 1900, and was reviewed in NATURE of April 11, 1901 (vol. lxiii. p. 557), has reached a second edition. The work provides students with a text-book in which chemistry is developed from the outset in accordance with modern theoretical knowledge. The book attracted immediate attention, not only on account of the author's eminence as a teacher and investigator, but also because of its plan of treatment. The new and revised edition will certainly meet with the same success as the original work, of which the edition of four thousand copies was exhausted in about three years.

A SECOND edition of "Towers and Tanks for Water-works," by Mr. J. N. Hazlehurst, has been published by Messrs. Wiley and Sons (London: Chapman and Hall, Ltd.). The book deals with the design and construction of metal stand pipes and tanks for storing up water at a sufficient elevation to provide adequate pressure for its proper distribution. A review of the original volume appeared in NATURE of September 26, 1901 (vol. lxiv. p. 525). Another work just published by Messrs. Wiley is the eighth edition of "The Theory and Practice of Modern Framed Structures," by Messrs. J. B. Johnson, C. W. Bryan, and F. E. Turneure. This comprehensive volume is designed for use in technical schools and by engineers in professional practice. A large part of the original work has been re-written, and many changes have been made in other parts to bring them into close touch with modern practice. The new designs and improvements in methods of description, the practical character of the text and illustrations, and the use made of graphical representation, combine to make the volume one to which all students of engineering should have access.

A DETERMINATION of the molecular weight of solid phosphoretted hydrogen, described by Messrs. Schenck and Buck in a recent number of the *Berichte*, has shown that this compound has a more complex formula than that which has usually been assigned to it. The method employed, consisted in determining the depression of the freezing point of a solution in yellow phosphorus, and the results obtained indicate that the molecular weight corresponds with the formula $P_{12}H_6$, and not with the simple formula P_4H_2 .

M. GUILLAUME sends a correction of the note on nickel-steel which appeared in our issue of March 24 (p. 496); the coefficient of expansion of γ -iron is greater than that

of α -iron, and all non-magnetic steels in which the iron is retained in the γ form, such as Hadfield's manganese steels, retain the large coefficient of expansion characteristic of this modification of iron. M. Guillaume adds that "the function of nickel in the alloys is essentially to unite into a single change the two transformations of pure iron, and thus, as M. Osmond has shown, to eliminate altogether the β variety; then, on account of the state of mutual dissolution in which the two chief constituents of the alloy are found, to create an equilibrium varying with the temperature, such that the transformation of α into γ iron and conversely takes place over a considerable interval instead of being concentrated at a single point as in pure iron."

A SOMEWHAT striking observation is recorded by Dorn in the *Physikalische Zeitschrift*. A tube of alkali-free Jena glass, containing 30 mg. of radium bromide, had been sealed up on December 3, 1902, in order that some experiments might be carried out on the supposed loss in weight of radium salts. Six months later, on May 27, 1903, it was desired to open the tube. This was done by means of a triangular file, but as soon as the metal touched the surface of the glass the tube was pierced by an electrical spark so bright as to be clearly visible in broad sunlight close to the window, whilst the sound was mistaken by an assistant in the room for the discharge of an induction coil. It is suggested that the retention in the tube of the positively charged α particles and the escape of the negatively charged β particles must have set up a potential difference between the inside and the outside of the tube so great that it was ultimately able to pierce through 0.3 mm. of glass.

THE electrochemical behaviour of radium is discussed by Mr. Alfred Coehn in a recent number of the *Berichte*. From the thermochemical data it would appear that the separation of the metal would be increasingly difficult in the series Ca, Sr, Ba, but when a mercury cathode is used the voltage required is greatly reduced owing to the energy liberated in the formation of an amalgam, and the order in which the metals separate is reversed. Thus it requires 0.2 volt more to separate strontium than barium, and 0.25 volt more to separate calcium than strontium; if the series were continued radium should require 0.3 or 0.4 volt less than barium, and metallic radium can actually be precipitated by barium amalgam. Owing to the very small proportion of radium in the crude bromide it is impossible to effect a sharp separation of the metals except with an impracticably small current density, but a considerable concentration may be effected by this method. It is of interest to note that freshly prepared (unoxidised) radium amalgam, like the salts of the metal, only slowly attains its maximum activity, whilst the silver anode, which at first exhibits a very powerful induced activity, soon becomes altogether inactive.

THE additions to the Zoological Society's Gardens during the past week include a Maccarthy's Ichneumon (*Herpestes fulvescens*) from Ceylon, presented by Mr. Arthur M. Dowson, R.N.; a Leadbeater's Cockatoo (*Cacatua leadbeateri*) from Australia, presented by Mr. W. A. Ridley; a Cocteau's Skink (*Macroscolecus cocteaui*) from the Cape Verde Islands, presented by Mr. — Hastings; two Painted Frogs (*Discoglossus pictus*), European, presented by Dr. F. G. D. Drewitt; three Jays (*Garrulus glandarius*), British, purchased; an Eland (*Orias canna*), a Mouflon (*Ovis musimon*), eight American Timber Wolves (*Canis occidentalis*), a Muscat Gazelle (*Gazella muscatensis*), born in the Gardens; a Black Swan (*Cygnus atratus*), bred in the Gardens.